

6.0 INTEROPERABILITY CHANNELS

The purpose of interoperability channels is to provide a means for public safety agencies to effectively respond to mutual aid situations by facilitating communication with each other. The RPC will administer interoperability channels under National Coordination Committee guidelines. Base stations on the I/O channels require licensing. Mobile stations do not require a license.

The narrowband voice & data interoperability channels (sixty-four at 6.25 kHz bandwidth) are defined on a nationwide basis. Appendix A shows the designation of these channels as defined by the 700 MHz National Coordination Committee (NCC). Since they are nationwide channels, each channel must have the same usage within each Region and across Regional borders. They have been sub-divided into different service categories.

The Digital Interoperability Standard for the conventional-only mode of operation on the narrowband voice and data interoperability channels adopted by the NCC and approved by the FCC, is the ANSI/TIA 102 Standards (i.e., Project 25 digital protocols).

There are 2 Calling channel sets and 30 Tactical channel sets. Channel Sets are comprised of two 6.25 kHz bandwidth channels each. The Tactical channel sets are subdivided into the following recommended categories:

- 4 for Emergency Medical Service
- 4 for Fire Services,
- 4 for Law Enforcement Services,
- 2 for Mobile Repeater operation,
- 2 for Other Public Services, and
- 12 for Public Safety General Services.
- 2 for Data

6.1 Standardized Nomenclature:

Standardized nomenclature is recommended nationwide. All 700 MHz public safety subscriber equipment using an alphanumeric display of at least eight digits should be programmed to show the recommended label from the Table in Appendix A - Corrected when programmed to operate on the associated 700 MHz channel set. The Table shows the recommended label for equipment operating in the mobile relay (repeater) mode. When operating in direct (simplex) mode, the letter "D" should be appended to the end of the label.

6.2 Calling Channels

The 700 MHz licensees will be responsible for monitoring the interoperability calling channels. The RPC will develop operational guidelines.

Because the 700 MHz band will be initially encumbered by broadcast television in some areas, two of the interoperability channels sets are reserved as "Calling Channels". The RPC will define when and where the two calling channels are to be used. These calling channels, which appear in the Table of Interoperability Channels (Appendix A) as "7CAL59" and "7CAL75" must be monitored, as appropriate, by licensees who employ interoperability infrastructure in the associated channel group. In addition to the usual calling channel functions, the calling channels may be used to notify users when a priority is declared on one or more of the tactical interoperability channels. Any system plan submitted for approval must include a design for the interoperability channels that will meet their purpose as defined by the FCC.

6.3 Tactical Channels

All Interoperability channels, except as described below, shall be used for conventional-only operation.

Normally, users will 'call' a dispatch center on one of the "Calling Channels" and be assigned an available tactical channel. Deployable narrowband operations (voice, data, and trunking) shall be afforded access to the same pool of channels used for similar fixed infrastructure operations. In the event of conflict between multiple activities, prioritized use shall occur. The Region 22 plan will not set aside additional channels for interoperability use within the region. It is expected that the sixty-four FCC designated channels (6.25 kHz) will be sufficient for the region.

6.4 Encryption

Use of encryption is prohibited on calling channels and permitted on all other interoperability channels. A standardized encryption algorithm for use on the interoperability channels must be TIA/EIA IS AAAA-A Project 25 Block encryption protocol.

6.5 Deployable Systems

This plan supports the use of deployable systems to provide additional coverage and capacity to minimize the expense of the alternative of implementing a fixed infrastructure. These prepackaged systems can be deployed when needed to provide additional support for interoperability.

Conventional deployable systems should be capable of operating on any of the interoperability tactical channels. The agencies that are a part of a multi agency trunked system are encouraged to have trunked deployable systems on those channels designated for trunked use. The RPC will develop operational procedures for these systems.

6.6 Trunking on the Interoperability Channels

Trunking the Interoperability channels on a secondary basis shall be limited to operation on eight specific 12.5 kHz bandwidth channel sets, divided into two subsets of four 12.5 kHz bandwidth channels. One subset is defined by 7TAC58 through 7EMS61 and the other by 7FIR65 through 7LAW68.

Any licensee implementing base station operation in a trunking mode on Interoperability Channels shall provide and maintain on a continuous basis (24 hr x 7 day), at its primary dispatch facility, the capability to easily remove one or more of these interoperability channels. Interoperability Channels must be removed from trunking operation when a conventional access is necessary having priority equal to or higher than the trunked use.

While it may be desirable for the Regional Planning Committee to permit trunked radio systems to incorporate one or more of the Interoperability channels into a single trunking system as a means of enhancing the use of the system for interoperability purposes (and by implication allow those channels to be routinely used for normal day-to-day communications), care must also be given to ensure that those channels do not become such an integral part of the trunked system operation that it becomes politically and technically impossible to extract them from the trunked system in the event of an emergency event having higher priority. For this reason, the NCC Interoperability Subcommittee recommends that the Regional Planning Committee limit the number of Interoperability channels that may be integrated into any single trunked system to the following amounts:

For systems having 10 or fewer "general use" voice paths allocated, one (1) trunked Interoperability Channel set is permitted. For systems having more than 10 "general use" voice paths allocated, two (2) trunked Interoperability Channel sets are permitted.

The Regional Planning Committee may allot additional Interoperability Channel set(s) for trunked systems having more than 20 "general use" voice paths allocated upon a showing of need and upon a determination that assignment of the Interoperability Channel set(s) will not adversely impact availability of those channels to other trunked and/or conventional radio systems in the area (e.g. a single consolidated trunked system servicing all public safety agencies in an area might satisfy this criterion). The maximum number of Interoperability channel sets for trunked systems permitted for use by an individual licensee is four.

The channels (two 6.25 kHz bandwidth pairs) in Reserve Spectrum immediately adjacent to the channels where secondary trunking is permitted [(21, 22), (101, 102), etc. are available for secondary trunking, but only in conjunction with the adjacent Interoperability 12.5 kHz bandwidth channel pair in a trunked system and will be administered by the RPC.

6.7 Standard Operating Procedures on the Trunked I/O Channels for I/O Situations above Level 4

The safety and security of life and property determines appropriate interoperable priorities of access and/or reverting from secondary trunked to conventional operation. In the event secondary trunked access conflicts with conventional access for the same priority, conventional access shall take precedence. Access priority for "mission critical" communications is recommended as follows:

1. Disaster and extreme emergency operations for mutual aid and interagency communications;
2. Emergency or urgent operation involving imminent danger to life or property;
3. Special event control, generally of a preplanned nature (including Task Force operations);
4. Single agency secondary communications.
[Priority 4 is the default priority when no higher priority has been declared.]

For those systems employing I/O channels in the trunked mode, the RPC will set up interoperability talk groups and priority levels for those talk groups so that it is easy for dispatch to determine whether the trunked I/O conversation in progress has priority over the requested conventional I/O

use. The RPC will also determine whether a wide-area I/O conversation has priority over a local I/O conversation.

6.8 Data Only Use of the I/O Channels

Narrowband data-only interoperability operation on the Interoperability channels on a secondary basis shall be limited to two specific 12.5 kHz bandwidth channel sets. One set is defined by 7DAT71 and the other by 7DAT87.

6.9 Wideband Data Standards

Within the 12 MHz of spectrum designated for high capacity, wide bandwidth (50 to 150 kHz) channel usage, there are eighteen 50 kHz bandwidth (or six 150 kHz) channels designated for wideband interoperability use.

The Technology Subcommittee has recommended the Scalable Adaptive Modulation (SAM) operating on 50 kHz channels, with 16 QAM modulation be adopted as the standard for wideband interoperability channels. At the July 17, 2003 meeting, the NCC Technology Subcommittee recommended that the National Coordination Committee (NCC) Steering Committee adopt and recommend to the FCC that the following six standards be required for use on the FCC designated 700 MHz wideband I/O channels:

1. TIA-902.BAAB Wideband Air Interface Scalable Adaptive Modulation (SAM) Physical Layer Specification Public Safety Wideband Data Standards Project Digital Radio Technical Standards, February 2002, Telecommunications Industry Association.
2. TIA-902.BAAD Wideband Air Interface Scalable Adaptive Modulation (SAM) Radio Channel Coding (CHC) Specification Public Safety Wideband Data Standards Project Digital Radio Technical Standards. September 2002, Telecommunications Industry Association.
3. TIA-902.BAAC Wideband Air Interface Media Access Control/Radio Link Adaptation (MAC/RLA) Layer Specification Public Safety Wideband Data Standards Project Digital Radio Technical Standards. September 2002, Telecommunications Industry Association.
4. TIA-902.BAAE Wideband Air Interface Logical Link Control (LLC) Specification Public Safety Wideband Data Standards Project

- Digital Radio Technical Standards. September 2002, Telecommunications Industry Association.
5. TIA-902.BAEB Wideband Air Interface Packet Data Specifications (PDS) Specification Public Safety Wideband Data Standards Project Digital Radio Technical Standards. May 2003, Telecommunications Industry Association.
 6. TIA-902.BAAF Wideband Air Interface Mobility Management (MM) Layer Specification, Public Safety Wideband Data Standards Project Digital Radio Technical Standards. May 2003, Telecommunications Industry Association.

The NCC Steering Committee forwarded this recommendation to the FCC who, as of July 25, 2003, had taken no formal action on the proposal.

6.10 Region 22 Interoperability Executive Committee

The Regional Planning Committee shall administer a State Interoperability Plan. This plan will include, but not be limited to, interoperability operations on the 700 MHz interoperability channels. VHF and UHF narrowband Interoperability channels of the public safety pool (90.20) will also be included. The committee includes an equal number of representatives each providing regional representation from state, county, and local governments, with additional representation from special districts and federal agencies, as appropriate. The committee shall represent all disciplines, in which case emergency medical, fire, forestry, general government, law enforcement, and transportation agencies from each level of government shall be represented equally.

The RPC will use the Incident Command System (ICS) as a guideline in developing Regional interoperability plans. (See Appendix J).

Because of limited resources, the RPC may designate the State to hold licenses on interoperability channels for all infrastructure and subscriber units within the state.

The RPC will oversee the administration and technical parameters of the interoperability channels within the region.

Recommended templates for a *Memorandum of Understanding for Operating the 700 MHz Interoperability Channels* and a *Sharing Agreement* are described in Appendix's B&C. The MOU shall be typed on

appropriate committee letterhead and the Sharing Agreement on agency letterhead. (See Appendices B&C).

6.11 Minimum Channel Quantity

If all calling and tactical voice channels are desired, the minimum channel quantity is 8 I/O channel slots in each subscriber unit. Including direct (simplex) mode on these channel sets, up to 16 slots in each radio will be capable of being programmed for I/O purposes. Backbone issues are deferred to the RPC. Subscriber units, which routinely roam through more than one jurisdiction up to nationwide travel may require more than the minimum channel quantity.

The "CALL"ing channel sets (7CAL59 and 7CAL75) shall be implemented in all voice subscriber units in repeat-mode and direct (simplex) mode. "Direct" mode is permitted in the absence of repeat operation or upon prior dispatch center coordination. If the local CALLing channel set is not known, 7CAL59 shall be attempted first, then 7CAL75. Attempts shall be made on the repeater mode first then on the direct (simplex) mode.

A minimum set of Tactical channels shall be implemented in every voice subscriber unit in the direct (simplex) mode. Specific channel sets are shown below.

- 7TAC63 & 7TAC79 channel sets
- 7TAC67 & 7TAC83 channel sets
- 7TAC73 & 7TAC89 channel sets

Voice subscriber units subject to multi-jurisdictional or nationwide roaming should have all I/O voice channels, including direct (simplex) mode, programmed for use.

The need for interoperability channel programming will be determined as standards are developed, and systems are built.

6.12 Direct (Simplex) Mode

In direct (simplex) mode, transmitting and receiving on the output (transmit) side of the repeater pair for subscriber unit-to-subscriber unit communications at the scene does not congest the repeater station with unnecessary traffic. However, should someone need the repeater to communicate with the party who is in "direct" mode, the party would hear

the repeated message, switch back to the repeater channel, and join the communications. Therefore, operating in direct (simplex) mode shall only be permitted on the repeater output side of the voice I/O channel sets.

6.13 Common Channel Access Parameters

Common channel access parameters will provide uniform I/O communications regardless of jurisdiction, system, manufacturer, etc. Thus, the Calling and TAC channels (all of them) should include a common NAC as the national standard. The secondary, trunked I/O channels would be excluded in the trunked mode. However, when reverted to conventional I/O, the common NAC would then apply. This national requirement should apply to base stations and subscriber units. This should apply to fixed or temporary operations for tactical or other mutual aid conventional I/O use.

Common channel access parameters for all voice I/O shall utilize the default values (ANSI/TIA/EIA-102, BAAC-2000, approved April 25, 2000) provided in every radio regardless of manufacturer.

7.0 ADDITIONAL SPECTRUM SET ASIDE FOR INTEROPERABILITY WITHIN THE REGION

The RPC will not designate any additional general use channels for interoperability use. The consensus is that the 32 narrowband channels and 18 wideband channels are sufficient for interoperability use.

8.0 ALLOCATION OF GENERAL USE SPECTRUM

The Narrowband general use spectrum refers to the block of frequencies designated for local public safety users. The FCC has allocated six hundred and sixteen 6.25 kHz bandwidth channel pairs for general use. Region 22's plan distributes spectrum in 25 kHz building blocks, each comprised of four 6.25 kHz or two 12.5 kHz bandwidth channels.

The channels are distributed according to an allotment plan developed for the National Public Safety Telecommunications Council NPSTC and the National Institute of Justice by the New York Technology Enterprise Corporation and Syracuse Research Corporation, NYSTEC. The methodology of the Safety Pool Allotments, (Narrowband General Use Channel Set) documentation of Methodology and Results" January 31, 2003. The report can be found at www.NPSPAC.org and Appendix AAA.

8.1 Summary of The NYSTEC Methodology:

- Use population and population density characteristics in evaluating capacity needs. Employ PSWAC like capacity requirement models to introduce increased accuracy in the modeling process.
- Use terrain data for service-area evaluation and interference prediction. This will allow greater accuracy in the process, and will result in more efficient reuse of the spectrum.
- Use contour intersections to evaluate the validity of pre-allotment channel sets. Build upon past experience in developing quasi-optimal spectral allotment solutions.
- Pre-allot "pool" channels in aggregate 25 kHz blocks. Allow a minimum of four blocks per allotted (county like) area – three for voice, and one for data. Allot additional spectrum based upon projected need (normalized by the spectrum available), and local availability.
- Allot all areas of the U.S. as listed in the in the NYSTEC Report in the Appendix under Technical Reports. which includes fifty states and Puerto Rico.
- When considering allotable spectrum blocks, make no attempt to work around either U. S. International broadcast-television services. Many of these station assignments are either temporary, or subject to change, and working around them would have resulted in allotment inefficiencies.

Each county allotment is a contiguous 25 kHz block consisting of:

- (4) 6.5 kHz channels or
- (2) 12.5 kHz channels

It maintains at least 250 kHz separation with other allotments within each county. Each county received a minimum of 5 of these 25 kHz blocks. The remaining was allotted according to the capacity model, and reuse constraints. Terrain and U.S. borders affect availability. For areas along the Canadian border above line A the RPC must note that any public safety allocations within that area subject to future treaties with these counties.

8.2 Narrowband Allotments

The Narrowband allotment completed by NYSTEC and adopted by the RPC is shown as a listing of channel assignments in Attachments 7 and 8. The most current listing can be found on the CAPRAD database.

8.3 Wideband Data Channel Allotment

This section describes the allotment methodology for the forty-eight wideband channels in Minnesota Region 22. Channels are allotted to geographic areas bounded by county borders. Any Public Safety agency which has jurisdiction in the area is eligible to license these channels. Examples include State, County and City government and other governmental Public Safety Agencies. Because of the limited number of wideband channels, the RPC will give preference to multi-agency systems.

The allotment approach includes provisions for both 50 KHz and 150 KHz technologies. Some 50 KHz systems require non-adjacent channel assignments because of interference considerations. In the populated areas, assigning channels in 150 KHz groups as per the FCC channel plan could generate numerous orphan channels if 50 KHz systems are implemented, resulting in a reduction of overall spectral efficiency.

The described approach seeks a balance between allotments optimized for the requirements of 50 KHz and 150 KHz systems, while preserving most 150 KHz groupings per the FCC channel plan. The allotment plan is described for Outstate Counties and the Metro region including First and Second tier Collar Counties. The Metro area allotment is based on a Metro Radio Board paper entitled "A Plan for Adding a High-Speed Mobile Data Communications Layer to the Region-Wide Public Safety Radio Communications System" per Attachment 10.

8.3.1 Wideband Coverage / Protection Ratio

The coverage area for a wideband system includes a 40 dBu service contour of the applicant's primary jurisdiction plus three (3) miles as per paragraph 8.12. The applicant must demonstrate that the co-channel and adjacent channel interference contours do not overlap the service area of a licensee or the boundary of the allocation as per paragraph 8.13.

The target separation assuming flat terrain for the Metro and Collar counties was 34 miles conservatively measured between county boundaries. Because of the limited number of channel groups and the large number of counties, the separation distance of the allotment was relatively close. A system using these channels

must be designed to accommodate the limitations presented by the short-spacing requirements of the allocations. This can be accomplished by using design techniques such as locating towers strategically, using directional and downtilt antennas and a reduction of power.

The table of Attachment 11 shows the co-channel geographic separation required between typical systems with various antenna heights. These examples are intended as a reference to evaluate systems for compliance with required NCC interference levels.

The target separation assuming flat terrain for outstate allocations was 45 miles between county borders allowing for a less restrictive design than for the Metro and Collar areas.

8.3.2 Allotment Plan

The FCC has arranged the wideband 50 KHz channels into groups of three adjacent channels which can be aggregated to 100 KHz or 150 KHz. At this time several potential technologies have been identified. One technology uses FM modulation with 50 KHz bandwidth and requires separation from the adjacent channels to minimize interference. Another technology employing SAM (Scalable Adaptive Modulation) also uses 50 KHz bandwidth but can be expanded to 100 KHz or 150 KHz to fully utilize the FCC channel plan. It has been suggested that this technology is less affected by co-channel and adjacent interference than by an FM approach. Another proposed technology is a fast hopped version of Orthogonal Frequency Division Multiplex (OFDM) and based on a FDD (Frequency Division Duplexing) mechanism which requires 1.25 MHz of contiguous bandwidth.

The RPC's scope is to develop a technologically neutral allotment plan for the 87 counties, 4 major cities and state government using only forty eight 50 KHz channels or sixteen 150 KHz FCC groups. The basic philosophy of the plan is to allocate a minimum number of channels with assurance that every area of the state is covered. Sharing systems to achieve spectral efficiency and interoperability is encouraged. The 150 KHz channel groups have been kept intact except for specific areas where 50 KHz systems will be implemented.

The RPC will consider applications for unassigned channels if it can be shown that licensing those channels will not interfere with other licensees, plan allocations, and can be coordinated with adjacent regions.

There are fifty-four 50 KHz channels kept in reserve by the FCC. It is expected that they will be released eventually for use to give new technology a "clean slate" at some future date. Region 22 has identified this spectrum for potential use for the OFDM technology which requires 1.25 MHz of contiguous spectrum.

Four or five 150 KHz reserve groups assigned strategically in the metro region could significantly extend the 34 mile target separation between the county allocations

The Minnesota 700 MHz Wideband Allotment Plan described in Attachments 12 and 13 separates the forty eight 50 KHz channel into two supergroups each consisting of 24 channels designated as A and B. Supergroup A is composed of twenty-four 50 KHz channels which can be grouped as three contiguous channels when assigned outstate. The same A supergroup channels are assigned as a 24 channel block without any particular grouping if allocated to the Metro or Collar county area. While supergroup B also consists of twenty-four 50 KHz channels it must, however, be allotted in groups of three contiguous 50 KHz channel groupings. While the users may implement individual 50 KHz channels and create orphans, the 150 KHz allotment must continue to reside with the assigned county. Attachment 14 shows the separation between county borders for the Region 22 Wideband Allotment Plan. The wideband data channels and contiguous group designations are shown in Attachment 15 .

Every county in the state is assigned three contiguous channels from the FCC supergroup that can be used as individuals or aggregated. This manner of assignment is intended to insure that the FCC grouping is kept intact. All channels of the (A) supergroup are assigned as a block for use in the Metro and First Tier Collar Counties. The RPC using the technical system design of the Metropolitan Radio Board will develop a specific channel plan for the (A) supergroup. See 8.3.3.

A single channel is assigned from the (A) supergroup to each Second Tier Collar county. The intent is to minimize assignments to the Second Tier Collar counties to reduce impact to the Metro Plan. The RPC allows Second Tier Collar Counties to use other channels of the (A) supergroup provided that they can coordinate with the Metro Plan. The RPC has assigned additional channels of either supergroup to population center such a Duluth, Moorhead, St. Cloud and Rochester.

The Region 22 plan has left additional channels unassigned so that they can be assigned to neighboring regions in the border areas. The allotment plan will be coordinated with the adjacent regions.

8.3.3 Wideband Data Metro Plan

The Metropolitan Radio Board or its successor is in the process of developing a technical plan for a shared wideband data system using 50 KHz channels for the Metro area. It is anticipated that the system would first be implemented in the seven county Metro area with eventual expansion to the First Tier Collar Counties.

The RPC will accept applications for the twenty-four channels of the (A) supergroup upon its adoption of the Metro Data Plan. It is expected that the RPC planning process for the twenty-four 50 KHz channels will be an ongoing task as the network develops.

1. The purpose of the plan is to utilize the twenty-four 50 KHz channels for an integrated system(s) covering seven (7) Metro with possible expansion to twelve (12) First Tier and Collar Counties.
2. Assure that each county is afforded enough frequency resources to accommodate anticipated traffic for coverage throughout the county.
3. Base the channel reuse distance on coverage/interference criteria developed by the National Coordinating Committee.
4. Protect the (A) supergroup for the Metro and First Tier Collar counties by minimizing channel assignments in the Second Tier Collar counties.
5. It is expected that the Metropolitan Radio Board will develop a technical data network plan for the seven county metro area. The plan shall be submitted to the RPC for review by February 1, 2006. License applications will be accepted by the RPC upon approval of the plan.
6. License applications will not be approved unless compliant with the plan.

8.3.4 Wideband Data Interoperability Channels

The FCC's channel plan has designated eighteen 50 KHz channel pairs for interoperability use, as shown in the table of Appendix A. Pairs 46/166, 48/168, 73/193 and 75/196 are assigned as 50 KHz

nationwide commons with no aggregation. These interoperability channels should be considered a priority for implementation as part of a major wideband system.

The primary purpose of the wideband interoperability channels is to provide a channel for users from other areas or different systems to access a given system. An important consideration in determining how interoperability channels are used in Region 22 is whether the FCC adopts the wideband data standard as per 6.9. If the standard is adopted all subscriber units will be able to access any system on interoperability channels.

Region 22 is encouraging agencies to integrate their systems so that interoperability is inherent in the resulting network. In many cases this will allow interoperability whether the data standards are adopted or not and the main function of the interoperability channels will be to allow users from other areas to access the system.

A licensee implementing interoperability channels is permitted to maintain day-to-day communications on the channels provided that the applicant/licensee demonstrates that the system has enough capacity available to accommodate interoperability events.

While it may be desirable for the Regional Planning Committee to permit wideband radio systems to incorporate one or more of the interoperability channels into a single system as a means of enhancing the use of the system for interoperability purposes (and by implication allow those channels to be routinely used for normal day to day communications), care must also be given to ensure that those channels do not become such an integral part of the daily wideband data system operation that it becomes politically and technically impossible to extract them from the wideband data system in the event of an emergency event having higher priority. For this reason the Region Planning Committee limited the number of interoperability channels that may be integrated into any single wideband system to the following;

For systems having three or fewer 50 KHz channels allocated, one (1) 150 KHz contiguous interoperability group is permitted. For systems having more than six (6) 50 KHz channels, two (2) interoperability 150 KHz contiguous groups channel sets are permitted.

8.3.5 Interoperability Assignments

The purpose of assigning specific wideband interoperability channels at this time is to facilitate planning for the most likely agencies that can fund implement effective and widely - used interoperability systems.

The RPC assigns pairs 28/148, 29/149, 30/150 for implementation by the Metro integrated system. It also assigns pairs 37/157, 38/158, 39/159, 82/202, 83/203, and 84/204 to state government for statewide implementation.

The remaining wideband interoperability groups are left unassigned for use as needed in order to maintain an open, flexible plan.

8.3.6 Region 22 Intelligent Transportation Communication Infrastructure

The RPC recommends the assignment of channel pairs 47/167 and 74/194, on the basis of non-interference to the Nationwide Interoperability data channels, for applications related to Intelligent Transportation Systems as follows and as per attachment 16.

Statewide DGPS Broadcast System

Channel pair 47/167 is utilized in a region-wide DGPS system, providing interoperability for surveying and Intelligent Transportation System (ITS) applications among state, county and municipal governments.

Dedicated Long Range Communications (DLRC)

Channel pair 74/194 is utilized, in region-wide Intelligent Transportation System (ITS), providing dedicated long range communications for applications serving official highway maintenance and public safety. Channel is intended to fill wireless communications gap between deployments of Dedicated Short Range Communications (DSRC) sites.

8.4 Allotment Variances:

The general channel allotment can be considered a first cut for frequency planning for the Region. It is however, an essential step of the process in order to ensure coordination between regions. It allows agencies in any location to plan communications systems with a reasonable assurance that enough channels will be available to implement a useful modern communications system. Changes in the plan are expected especially after the five-year review.

An agency can apply for any channel regardless of the general or wideband channel allotment plan if it can demonstrate that it meets the plan's coverage/interference criteria, when compared with the plan's co-channel and adjacent channel licensees and allotments and can be coordinated with adjacent regions.

There are circumstances such as where an applicant may require a variance of the maximum service area such as where a site is near a county border or if the user anticipates signal overshoot because of an unusual in-building coverage requirement. At the discretion of the RPC, certain variances in maximum service area may be allowed if there are no co-channel users in that direction. Variances will be considered by the RPC on a case by case basis. The RPC will require applicants to provide detailed coverage/interference predictions in the application process.

8.5 Expansion on Initial Allocation:

In the event that the allocation for any county becomes depleted, the Region Planning Committee shall meet to make further allocations to said county. Should this occur, the applying agency or entity shall submit the proper license and coordination applications with all applicable fees, as in any other licensing request. Allocations will be made based on the initial frequency allocation plan as mentioned above, taking into consideration orphan channels, which were returned to the reserve pool.

8.6 Annexations and Other Expansions:

It is well known that as cities grow, annexations occur. When an expansion of the present city limits of any city currently using 700 MHz system within the spectrum as herein specified occurs, it is understood that the existing system may have to be expanded and its range increased. This is a modification and may be permitted. The increased range of the system will have to be determined at the time of modification to assure non-interference with any other existing system. Where interference is likely, the use of alternate methods of expansion, such as satellite systems or multiple transmitters sites with reduced heights may be necessary. Should the annexation or expansion of a city effectively take in all or most of a county, the allocation for that county may be given to the city if required by said city and not in use or planned to be used by the county. Where more spectrum is not available from the initial allocation, the rules for expansion of initial allocation, as contained in this plan, shall apply.

8.7 NPSPAC Channels:

If a county has not yet exhausted its 821 MHz allotment the 700 MHz RPC should work with the applicant encouraging it, where technically appropriate to complete the 800 MHz spectrum. The purpose is to ensure utilization of all allocated spectrums with similar characteristics.

8.8 Orphaned Channels

The narrowband pool allotments will have a channel bandwidth of 25 kHz. These 25 kHz allotments are characterized as "Technology Neutral", i.e. able to accommodate multiple technologies utilizing multiple bandwidths. If agencies choose a technology that requires less than 25 kHz channel bandwidth for their system, there is the potential for residual, "orphaned channels" of 6.25 kHz or 12.5 kHz bandwidth immediately adjacent to the assigned channel. The agency shall identify orphaned channels in the request for coordination from the RPC during the license application process.

An orphaned channel presents an opportunity to achieve greater spectrum efficiency by allowing it to be utilized for other applicants on a first-come, first-served basis. Typically, it cannot be used effectively within the same county or adjacent county because of adjacent channel interference restrictions.

An applicant for an orphan channel must demonstrate that it meets the 5 dBu co-channel and 60 dBu adjacent channel interference criteria with the plan assignments and licensees' in the area. The application must be coordinated with the adjacent regions if it lies within 75 miles of a border area.

8.9 Periodic Re-Evaluation of Allotment

To accommodate population changes, changing technologies, and to maximize spectrum efficiency, a periodic re-evaluation of allotments and assignments is recommended. The RPC will revisit the general and wideband channel allotment every five years on a structured basis with published results. The review will ensure that all agencies have the opportunity to access spectrum commensurate with their needs.

8.10 Trunking Requirements

All systems operating in the Region having five or more channels will be required to be trunked. Those systems having four or less channels may be conventional however, it is strongly recommended that any entity licensing three or more "repeaters" use trunking technology in their system. Exceptions will be permitted only when a substantial showing is

made that alternative technology would be at least as efficient as trunking or that trunking would not meet operational requirements. Exceptions will not be granted routinely and strong showings as to why trunking is unacceptable must be presented in support of any request for exception.

Depending on systems loading and the need for multiple systems within an area, operators of wide area systems (including, but not limited to, designated "Monitoring Agencies") must provide for coordination between area-wide systems and "Monitoring Agencies". Single municipalities or agencies must restrict design and implementation of their system(s) to provide only the communications needed within its geopolitical boundaries. The use of trunked systems is encouraged, however if the total number of radios in service does not reach minimum loading criteria for a trunked system, that user must consider utilizing the next higher system level. If 700 MHz trunked radio is the smaller system users must consider consolidating their communications systems to formulate one large trunked system.

8.11 Transmitter Combining

The allotment is designed to provide a minimum frequency separation of 0.25 MHz between any two channels assigned to the same eligible at the same site. This separation is provided in order to enable more efficient combining of multiple transmitters to a single antenna. These separated blocks of frequencies also have a maximum size. That is, if the eligible has more frequencies that the maximum size of the combining block, then a second compatible block is created, and so on.

8.12 Definition of "Coverage Area"

"Coverage area" referred to in this plan is that geographical area throughout which the applicant has primary jurisdiction, plus approximately three (3) to five (5) miles, and throughout which the radio "base station(s)" to be installed are intended to provide a minimum received signal strength of 40 dBu (decibels above 1 microvolt, equivalent to approximately 4.6 microvolts across 50 ohms) to the associated mobile stations.

8.13 System Coverage Limitations

Every effort must be made to ensure the most possible re-use (shared) of spectrum by confining signal radiation of a system to only the geographical area throughout which the applicant has primary jurisdiction. It is recognized however that radio signals do not stop at jurisdiction borders nor do jurisdiction boundaries rarely center around a selected transmitter site. All possible considerations however given in the system's design to achieve this balance of signal propagation to the utmost.

Overlap or extended coverage must be minimized, even where systems utilizing 700 MHz trunked radio systems are proposing to inter-mix systems for cooperative and/or mutual aid purposes.

Antenna heights are to be limited to provide only the necessary coverage for a system. When antenna locations are restricted to only the "high-ground" transmitter outputs and special antenna patterns must be employed to produce only the necessary coverage with the proper amount of ERP.

The following TIA/EIA TSB88-A criteria must be met in the design of communication system utilizing frequencies in this allocation, assuming a 40 dBu service contour is provided by the desired stations throughout the intended service area.

1. The 40 dBu service contour will be allowed to extend beyond the service area by 3 to 5 miles depending on population (urban, rural). See Appendix K
2. The interfering co-channel 5 dBu contour must not overlap the 40 dBu contour of the system being evaluated.
3. An adjacent interfering (25 kHz) channel shall not be allowed to have its 60 dBu coverage overlap the 40 dBu contour of the system being evaluated.

Coverage/Interference evaluation can be analyzed using any of the commonly used coverage models including Bullington, Longley - Rice, Okumura, etc. Longley Rice (50-50-50) with land use is used exclusively by several Public Safety Coordinators.

The location and design of such systems however must anticipate the potential for interference from other systems operating within this plan's guidelines. The criteria listed above are intended to provide protection to only receivers located at the base or mobile relay stations site.

Applicants choosing to operate a system with less than a 40 dBu signal contour within their coverage area should be cognizant that noticeable co-channel interference may be experienced from other co-channel users who have systems conforming to these radiated power limitations.

8.14 Use of Frequencies in Aircraft

The degree to which these 700 MHz channels are to be "re-used within the Region and their assignments in adjacent regions require that their use in aircraft be restricted. Limitations are:

1. A maximum ERP of 1.0 watt above 500 ft. AGL.

2. Avoid using the input frequency to the mobile relay station and use the "talk-around" mode whenever possible.

8.15 Determination of Coverage

There are four variables used in determining the area of coverage of a proposed system. These variables are (1) the required strength of the received signal, (2) antenna height above average terrain (HAAT), (3) the effective radiated power (ERP) of the system, and (4) the type of environment.

Received Signal Strength:

For purpose of this plan, received signal strength shall be the determining factor, which defines the actual boundary of the system. The signal level which marks the outer boundary of a system must not exceed 40 dBu.

Antenna Height

Shall be the height of the antenna above the average terrain surrounding the tower site.

Effective Radiated Power (ERP).

The ERP is the transmitter output power times the net gain of the antenna system. The actual formula is:

$$\text{ERP (watt)} = \text{Watts} \times \text{antilog} (\text{Net Gain}/10)$$

8.16 Canadian Coordination

Region 22 licensees *North of line A* must accept any interference that may be caused by operations of UHF television broadcast transmitters in Canada and that conditions may be added during the term of the license if required by the terms of international agreements between the United States and the Government of Canada, as applicable, regarding the non-broadcast use of the 764-806 MHz bands. Public Safety licensees are granted subject to the conditions set forth in 47 C.F.R. Paragraph 90.533.

9.0 AN EXPLANATION OF HOW NEEDS WERE ASSIGNED PRIORITIES IN AREAS WHERE NOT ALL ELIGIBLES COULD RECEIVE LICENSES.

Outside of the immediate Twin City metropolitan area, very few of the 800 MHz NPSPAC channels have been licensed. The RPC feels that adequate channels will be available throughout greater Minnesota in the 700 MHz and 800 MHz bands. The construction of the 800 MHz system in the metropolitan area has addressed many of the needs, and potential needs. The desire of the Metropolitan Radio Board is to focus

the system using available 800 MHz resources, and supplement them with 700 MHz at some point in the future, if necessary. Prior to licensing any 700 MHz channels within a county, all PSAP's within the county must concur. If an agreement cannot be reached, a resolution by the requesting government entity shall be sent to the RPC for consideration. The RPC will work to develop an equitable allocation to meet the needs of those involved. The RPC may approve license applications, without concurrence of all parties.

The following matrix should be used to evaluate competing applications within the region. The matrix will be used when there are multiple agencies requesting the same channels within the same time frame. Total evaluation points will add to 100.

- Priority will be given to applicants involved with protection of life and property with consideration of the population being served. (15 points)
- Intersystem & Intra-system interoperability (10 points)

However well the proposed system will be able to communicate with other levels of government and services during an emergency on "regular" channels not the I/O channels. Interoperability must exist among many agencies to successfully accomplish the highest level of service delivery to the public during a major incident, accident, natural disaster or terrorist attack. Applicants requesting 700 MHz spectrum shall inform the region of how and whom they have been achieving interoperability in their present system.

The applicant shall stipulate how they will accomplish interoperability in their proposed system (gateway, switch, cross-band repeater, console cross patch, software defined radio or other means) for each of the priorities listed below.

1. Disaster and extreme emergency operation for mutual aid and interagency communications.
 2. Emergency or urgent operation involving imminent danger to life or property.
 3. Special event control, generally of a preplanned nature (including task force operations).
 4. Single agency secondary communications. Priority 4 is the default priority when not other priority is declared and includes routine day to day (non-emergency) operations.
- Loading (30 points)

Is the system part of a cooperative, multi-organization system? Is the application an expansion of a existing 800 MHz system? Have all 821 channels been assigned (where technically feasible)? A showing of maximum efficiency or a demonstration of the systems mobile usage pattern could be required in addition to loading information. Based on population, number of units (if number of units, are they take home, how many per office), what the talk groups?

- Spectrum Efficient Technology (10 points)

How spectrally efficient is the system's technology? Trunked systems are considered efficient "as well as any technological system feature, which is designed to enhance the efficient use of the system and provide for the efficient use of the spectrum."

- Systems Implementation Factors (20 points)

Demonstrate funding, demonstrate system planning. Provide a construction and implementation schedule. Is this going to be slow growth (within the next five years) or is it something that's ready to be implemented now? A document stipulating what the agency is planning to implement signed by an official within the organization who handles the money is required. Some concerns expressed in this category were: how one legally provided a document that proves subsequent year funding; the money does not start flowing until the equipment is in place; some agencies cannot bond until they have the frequencies.

- Geographic Efficient (10 points)

The ratio of subscriber units to area covered and the channel reuse potential were the two subcategories in this one. "The higher the ratio (mobiles divided by square miles of coverage) the more efficient the use of the frequencies. Those systems which cover large geographic areas will have a greater potential for channel reuse and will therefore receive a high score in this subcategory."

- Turnback Channels (5 points)

Consider the number of VHF and UHF channels given back. Consider the extent of availability and usability of those channels to others.

10. AN EXPLANATION OF HOW ALL THE REGION ELIGIBLES' NEEDS WERE CONSIDERED, AND TO THE EXTENT POSSIBLE, MET.

The entire planning process took place through open meetings, and solicited input from interested and affected parties. See Section 4 for further discussion about the process.

The CAPRAD system will be used for the license application process. See section 9 for further discussion of how needs were considered.

11. ADJACENT REGION COORDINATION

The Draft Plan was posted on the CAPRAD site following approval by the RPC. A printed copy was also delivered by US Mail to the Chairperson of each adjacent region.

Dispute resolution

- i) The following is the procedure for inter-regional coordination when a license application is made that is consistent with the Regional Plan.
- ii) Intra-regional review and coordination takes place, including a technical review resulting in assignment of channels.
- iii) After intra-regional review, a copy of those frequency-specific applications requiring adjacent Region approval, including a definition statement of proposed service area, shall then be forwarded to the adjacent Region(s) for review. This information will be sent to the adjacent Regional chairperson(s) using the CAPRAD database.
- iv) The adjacent Region reviews the application. If the application is approved, a letter of concurrence shall be sent, via the CAPRAD database, to the initiating Regional chairperson within thirty (30) calendar days.
- v) If the adjacent Region(s) cannot approve the request, the adjacent Region shall document the reasons for partial or non-concurrence, and respond within 10 (Ten) calendar days via email. If the applying Region cannot modify the application to satisfy the objections of the adjacent Region then, working group comprised of representatives of the two Regions shall be convened within thirty (30) calendar days to attempt to resolve the dispute. The working group shall then report its findings within thirty (30) calendar days to the Regional chairpersons email (CAPRAD database). Findings may include, but not be limited to:
 - i) unconditional concurrence;
 - ii) conditional concurrence contingent upon modification of applicant's technical parameters; or
 - iii) partial or total denial of proposed frequencies due to inability to meet co-channel/adjacent channel interference free protection to existing licensees within the adjacent Region.
- vi) If the Inter-Regional Working Group cannot resolve the dispute, then the matter shall be forwarded for evaluation to the National Plan Oversight Committee (NPOC), of the National Public Safety Telecommunications

Council. Each Region involved in the dispute shall include a detailed explanation of its position, including engineering studies and any other technical information deemed relevant. The NPOC will, within thirty (30) calendar days, report its recommendation(s) to the Regional chairpersons via the CAPRAD database. The NPOC's decision may support either of the disputing Regions or it may develop a proposal that it deems mutually advantageous to each disputing Region.

- vii) Where adjacent Region concurrence has been secured, and the channel assignments would result in no change to the Region's currently Commission approved channel assignment matrix. The initiating Region may then advise the applicant(s) that their application may be forwarded to a frequency coordinator for processing and filing with the Commission.
- viii) Where adjacent Region concurrence has been secured, and the channel assignments would result in a change to the Region's currently Commission approved channel assignment matrix, then the initiating Region shall file with the Commission a *Petition to Amend* their current Regional plan's frequency matrix, reflecting the new channel assignments, with a copy of the *Petition* sent to the adjacent Regional chairperson(s).
- ix) Upon Commission issuance of an Order adopting the amended channel assignment matrix, the initiating Regional chairperson will send a courtesy copy of the Order to the adjacent Regional chairperson(s) and may then advise the applicant(s) that they may forward their applications to the frequency coordinator for processing and filing with the Commission.

12. A DETAILED DESCRIPTION OF HOW THE PLAN PUT SPECTRUM TO THE BEST POSSIBLE USE

Previous sections of the Plan discuss channel loading and the expectation that trunking technology will be used in most 700 MHz systems. Throughout the planning process, we evaluated all frequency resources that were available for use, and how these resources will best meet the needs of all users.

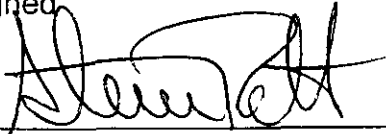
13. A DETAILED DESCRIPTION OF THE FUTURE PLANNING PROCEDURES

The Plan will be reviewed and updated every five years. Changes to the plan can be made more frequently when necessary. The 700 MHz RPC will take efforts to coordinate meetings of the other radio planning bodies to ensure that conflicting decisions are not being made.

**14. A CERTIFICATION BY THE REGIONAL PLANNING CHAIRPERSON THAT
ALL PLANNING COMMITTEE MEETINGS, INCLUDING SUBCOMMITTEE OR
EXECUTIVE COMMITTEE MEETINGS WERE OPEN TO THE PUBLIC.**

I hereby certify that all planning committee meetings, including subcommittee or executive committee meetings were open to the public.

Signed

A handwritten signature in black ink, appearing to read 'Steve Pott', written over a horizontal line.

Steve Pott, Region 22 Chairperson
Washington County Sheriff's Office

**700 MHz Regional Plan
Attachments**

Attachment 1	Region 22 By-laws
Attachment 2	Voting Membership
Attachment 3	Original Meeting Notices
Attachment 4	Meeting minutes
Attachment 5	Letter to Minnesota Indian Affairs Council
Attachment 6	Comparison of 700 MHz & 800 MHz NPSPAC Public Safety Channels
Attachment 7	Region 22 – Minnesota Channel Allotments by Class
Attachment 8	Region 22 – Minnesota Allotments by FCC Channel
Attachment 9	Grouping and Allotment Plan for 700 MHz State Channels
Attachment 10	A Plan for Adding a High-Speed Mobile Data Communications Layer to the Region – Wide Public Safety Radio Communications System – Metropolitan Radio Board
Attachment 11	Required Co-Channel Separation, 700 MHz Wideband Data
Attachment 12	Minnesota 700 MHz Wideband Channel Allotment Plan Per County
Attachment 13	Minnesota 700 MHz Wideband Channel Allotment Plan Per Channel
Attachment 14	700 MHz Wideband Allotment Plan – Assignment Separation
Attachment 15	Wideband Data Channels, 150 KHz Contiguous Groups
Attachment 16	Vehicle Infrastructure Integration (VII): A Minnesota Perspective
Attachment 17	Region 15 Concurrence and Dispute Resolution Documents
Attachment 18	Region 45 Concurrence and Dispute Resolution Documents